## 3.6.2. Static Position Accuracy

### 3.6.2.1. Purpose

The purpose of this test is to measure the static (ground position) accuracy of the coupled GPS/INS and the single GPS and INS over a mission relatable period to isolate errors that are not caused by the dynamic (flight) environment. The static accuracy becomes a baseline for measuring the effects caused by the dynamic environment.

### 3.6.2.2. General

In static testing, the coupled GPS/INS, GPS and INS are evaluated while the aircraft remains on the ground. Dynamic testing is performed while airborne. Static testing allows the errors caused by the INS and GPS, whether cyclic, linear, exponential, etc., to be isolated from errors induced by maneuvering effects. The static accuracy becomes the baseline from which to gauge the effects of the dynamics of flight. One mission relation for static accuracy is the requirement to perform quick reaction alerts with the system navigating statically on the ground until launch time.

### 3.6.2.3. Instrumentation

A stop watch and data cards are required for this test, a voice recorder is optional.

### 3.6.2.4. Data Required

Record the actual surveyed alignment location latitude and longitude. At five minute intervals, starting at time zero, record the elapsed time and the displayed latitude and longitude. Completely describe any aircraft motion, including the time that it occurs and note any GPS or INS fault indications.

### 3.6.2.5. Procedure

Complete an initialization and alignment as outlined in the previous test technique. As the INS is placed in a navigation mode, start the stop watch and record the displayed GPS and INS latitude and longitude. Record the displayed GPS and INS latitude and longitude every five minutes. Record which GPS satellites are being used, the quality number of each and finally the total GPS fix quality number at each interval. Completely describe any aircraft motion, along with the time of the occurrence. Record any GPS or INS fault indications. As a minimum, record data for the length of the maximum mission duration of the aircraft. Repeat the test with the INS turned off and then with the GPS turned off and the INS operating. Repeat the GPS tests without the GPS P code installed.

### 3.6.2.6. Data Analysis and Presentation

Subtract the displayed latitude and longitude from the surveyed latitude and longitude. Convert the latitude and longitude difference into nm using equation (21). Plot the data as error versus time. Annotate the plots with any significant events noted during the test, such as movement of the aircraft, system alerts and satellite switches or drops. Analyze the trend of the plots for possible causes of the errors as outlined in the theory section. Relate the static accuracy to the requirement to remain on the ground, while the INS navigates statically, for long periods of time before a quick response alert launch. Check to see if a significant change in the error plot occurs at the time of aircraft motion, when system alerts occur or after satellite changes. Relate the effects of aircraft motion to the requirement to perform maintenance on the aircraft after an alignment. Relate the static accuracy of the INS to the system alerts. If repeated alerts that imply degraded accuracy are not accompanied by that degradation, then they are false alarms. Completely investigate any INS alerts following the test. Relate the occurrence of confirmed false alarms to the possibility of unnecessarily aborted sorties.

For the case of the INS or GPS operating alone, and the case where the P code is missing, relate the drift to the requirement to perform the alert mission when the GPS user segment, control segment or space segment is not operating, when the INS is not functioning, or when the P code is lost or not available at the launch location, as appropriate.

### 3.6.2.7. Data Cards

A sample data card is provided as card 50.

CARD NUMBER ___

STATIC POSITION ACCURACY

[AFTER PERFORMING THE INITIALIZATION AND ALIGNMENT TEST, SELECT A NAVIGATION MODE, START THE CLOCK AND RECORD DATA AT TIME 0 AND EACH 5 MINUTES AFTER. DESCRIBE ANY SIGNIFICANT MOVEMENT OR SYSTEM ALERTS AS NOTES AT THE APPROPRIATE TIME. CONTINUE THE TEST FOR _____ MINUTES.] GPS ON ___ INS ON ___ BOTH ON ___ PCODE YES/NO

SURVEYED POSITION _____ _____

| POINT NUMBER | ELAPSED TIME | DISPLAYED INS LAT/LONG | DISPLAYED GPS LAT/LONG | SATS/QUAL AND FIX QUAL | NOTES: |
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Card 50: Static Position Accuracy Data Card